

REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a full and complete response to the Official Action dated March 18, 2003.

Claims 1-7 are under consideration in this application. The paragraph [0006] of the specification is being revised to be consistent with paragraph [0005] ("*by applying laser light to five locations, for example*"). Applicants hereby submit that no new matter is being introduced into the application through the submission of this response.

In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due reconsideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Prior Art Rejections

Claims 1, 4 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pat. No. 6,433,764 to Hebiguchi et al. (hereinafter "Hebiguchi") in view of the Japanese Patent No. 05-019294 (cited in the present application, hereinafter "JP'294"). In addition, claims 2-3, 5 and 7 were rejected as being unpatentable over Hebiguchi, and JP'294 and further in view of U.S. Pat. No. 6,456,013 to Komiya et al. (hereinafter "Komiya"). The prior art references of Ishii et al (6,525,705), Yoshida et al (6,496170), Higashi (6,023,260), Knapp et al. (6,498,595) and Ozawa et al. (6,522,315)) were cited as being pertinent to the present application. These rejections have been carefully considered, but are most respectfully traversed.

The liquid crystal display device of the invention, as now recited in independent claims 1, comprises: a liquid crystal; and two substrates opposed to each other with the liquid crystal interposed in between, the liquid crystal display device further comprising on a liquid-crystal-side surface of one of the two substrates: a plurality of gate signal lines; a plurality of drain signal lines that cross the plurality of gate signal lines; pixel regions each enclosed by two gate signal lines adjacent to each other and two drain signal lines adjacent to each other; a switching element that is provided in each pixel region and driven by a scanning signal supplied from one of the two gate signal lines that define the pixel region; a pixel electrode that is provided in each pixel region and supplied, via the associated switching element, with a video signal from one of the

two drain signal lines that define the pixel region; an insulating film; and a repair conductive layer formed so as to be contained in each of the plurality of drain signal lines when viewed perpendicularly with the insulating film interposed in between.

The present invention, as now recited in claim 4, is also directed to a liquid crystal display device comprising: a liquid crystal; and two substrates opposed to each other with the liquid crystal interposed in between, the liquid crystal display device further comprising on a liquid-crystal-side surface of one of the two substrates: an insulating film; a plurality of gate signal lines formed at a position closer to the one substrate than the insulating film is; a plurality of drain signal lines that cross the plurality of gate signal lines and are formed at a position closer to the liquid crystal than the insulating film is; pixel regions each enclosed by two gate signal lines adjacent to each other and two drain signal lines adjacent to each other; a thin-film transistor that is provided in each pixel region and driven by a scanning signal supplied from one of the two gate signal lines that define the pixel region; a pixel electrode that is provided in each pixel region and supplied, via the associated thin-film transistor, with a video signal from one of the two drain signal lines that define the pixel region; and a repair conductive layer formed at a position closer to the one substrate than the insulating film is so as to be contained in each of the plurality of drain signal lines when viewed perpendicularly.

The present invention, as now recited in claim 6, is also directed to a liquid crystal display device comprising: a liquid crystal; and two substrates opposed to each other with the liquid crystal interposed in between, the liquid crystal display device further comprising on a liquid-crystal-side surface of one of the two substrates: an insulating film; a plurality of gate signal lines formed at a position closer to the one substrate than the insulating film is; a plurality of drain signal lines that cross the plurality of gate signal lines and are formed at a position closer to the liquid crystal than the insulating film is; pixel regions each enclosed by two gate signal lines adjacent to each other and two drain signal lines adjacent to each other; a thin-film transistor that is provided in each pixel region and driven by a scanning signal supplied from one of the two gate signal lines that define the pixel region; a pixel electrode that is provided in each pixel region and supplied, via the associated thin-film transistor, with a video signal from one of the two drain signal lines that define the pixel region; and a repair conductive layer formed at a position closer to the one substrate than the insulating film so as to be contained in each of the plurality of drain signal lines when viewed perpendicularly, at least one of the plurality of drain signal lines having a disconnected portion and melt-formed portions that are located on both

sides of the disconnected portion and penetrate the insulating film.

As admitted by the Examiner, none of the cited prior art references teaches or suggests “a repair conductive layer formed in each of the plurality of drain signal lines when viewed perpendicularly with the insulating film interposed in between.”

Although the invention applies the general mechanism of “forming a bypass line on one side of a potential disconnection portion then irradiating it with a laser light if the disconnection in fact occurs” as disclosed in JP’294, the invention applies the mechanism on *each drain signal line* rather than a *source bus line* 23 (abstract, line 10) to achieve unexpected results or properties. For example, the repair mechanism only takes two applications of laser light ([0014]) rather than five as in JP’294. As another example, since each repair conductive layer is formed so as to be contained in the associated drain signal line when viewed perpendicularly, it does not prevent any increase of the pixel aperture ratio ([0015]) as does JP’294. As a third example, the arrangement of the invention avoids sacrificing one pixel to repair disconnection of the source bus line 23 which causes a pixel defect since a pixel electrode 41 is used for a bypass line as in JP’294 ([0008]). The presence of these unexpected properties is evidence of nonobviousness. MPEP§716.02(a).

“Presence of a property not possessed by the prior art is evidence of nonobviousness.

In re Papesch, 315 F.2d 381, 137 USPQ 43 (CCPA 1963) (rejection of claims to compound structurally similar to the prior art compound was reversed because claimed compound unexpectedly possessed anti-inflammatory properties not possessed by the prior art compound); Ex parte Thumm, 132 USPQ 66 (Bd. App. 1961) (Appellant showed that the claimed range of ethylene diamine was effective for the purpose of producing " 'regenerated cellulose consisting substantially entirely of skin' " whereas the prior art warned "this compound has 'practically no effect.' ").

Applicants will point out that “[t]he submission of evidence that a new product possesses unexpected properties does not necessarily require a conclusion that the claimed invention is nonobvious. In re Payne, 606 F.2d 303, 203 USPQ 245 (CCPA 1979). See the discussion of latent properties and additional advantages in MPEP § 2145.¹” However, the three unexpected properties were unknown and non-inherent functions in view of JP’294, since JP’294 does not inherently achieve the same results. In other words, these advantages would not flow naturally

from following the teachings of JP'294, since JP'294 fails to suggest applying a repair conductive layer in each of the plurality of drain signal lines.

Applicants further contend that the mere fact that one of skill in the art could rearrange the conductive body piece of JP'294 from a source bus line 23 to a drain signal line to meet the terms of the claims is not by itself sufficient to support a finding of obviousness. The prior art must provide a motivation or reason for one skilled in the art to provide the unexpected properties, such as applying laser light at two locations without lowering a pixel aperture ratio or incurring point defects (pixel defects), without the benefit of appellant's specification, to make the necessary changes in the reference device. *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984). MPEP§2144.04 VI C.

Applicants contend that neither Hebiguchi, JP'294, nor their combination teaches or discloses each and every feature of the present invention as disclosed in independent claims 1, 4 and 6. As such, the present invention as now claimed is distinguishable and thereby allowable over the rejections raised in the Office Action. The withdrawal of the outstanding prior art rejections is in order, and is respectfully solicited.

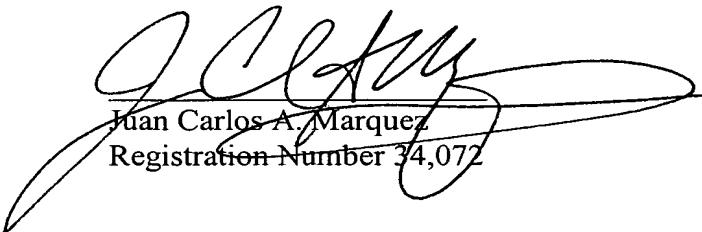
In view of all the above, clear and distinct differences as discussed exist between the present invention as now claimed and the prior art reference upon which the rejections in the Office Action rely. Applicants respectfully contend that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of

the above-captioned application, the Examiner is invited to contact the Applicants' undersigned representative at the address and phone number indicated below.

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to small signal line widths.

[0005] A technique for solving such a problem is disclosed in Japanese Patent Laid-Open No. 19294/1993. This technique prevents what is called a line defect that is caused by disconnection of a source signal line by forming, in each pixel, an electrical path of a source electrode (of a thin-film transistor) → a gate electrode (of the thin-film transistor) → a drain electrode (of the thin-film transistor) → a pixel electrode → a first conductor piece → a second conductor piece → a drain signal line by applying laser light to five locations, for example.

(Specifically, five times more laser light)

[0006] However, requiring two or more times of laser light application to repair a drain signal line, this technique has a problem that such work is cumbersome.

[0007] Since the first conductor piece and the second conductor piece need to be formed in each pixel region, this technique has another problem that the aperture ratio is lowered.

[0008] This technique has a further problem that point defects (pixel defects) are unavoidable though it can prevent line defects.

SUMMARY OF THE INVENTION

[0009] The present invention has been made in view of the above circumstances in the art, and an object of the invention is therefore to provide a liquid crystal display device in which a drain line can be repaired easily.

[0010] Another object of the invention is to provide a liquid crystal display device that does not obstruct increase of the pixel aperture ratio.

[0011] A further object of the invention is to provide a liquid crystal display device in which a point defect, not to mention a line defect, does not